

rooted in the mind by association of contiguity, and that thus an expectancy was raised for them of such urgency that transfer took place as occasion offered. The discussion of this subject takes up the greater part of the paper. (4) Embellishment is finery, which may be sexual, bellicose, proud, aggressive, or wanton, and not unfrequently these articles of embellishment cannot be regarded as examples of Fine Art. (5) The works of Fine Art can be sharply differentiated from Ornament. They have an altogether independent existence, and are not subordinate to serial repetition. It is their aim and end to excite a high order of emotion. If we admit that Fine Art exists solely for the purpose of furthering emotion, we may safely conclude that emotional craving originated it.

"In conclusion," writes Dr. Colley March, "the five elements of Art may be analysed upon an urn. Artifice has moulded a hollow vessel of earth, and has baked it so that it will hold water. As the gourd was in many cases its model, Expectancy has required its base to be much narrower than strict utility might have provided; but the ring that was once a stand for it has now become its foot. Artistic treatment has given it outlines that we, or others, call graceful; has coloured its clay, and washed its surface with a translucent glaze; and has carried aloft in symmetrical curves those handles that were once of ozie or of cords.

"Round the foot and shoulder and neck, Expectancy has drawn bands of Ornament, skeuomorphs [designs derived from technical methods of construction in handicraft] of binding, of basketry, or of textiles; and a phyllo-morph [or plant-design] is parasitic upon them. Embellishment has hung a foolish chain in a festoon between the handles. And Fine Art has filled the middle zone with a bas-relief, or a painting, that moves the soul.

'What leaf-fringed legend haunts about thy shape
Of deities or mortals, or of both,
In Tempe or the dales of Arcady?'

Thus, revealed upon a vase, we witness not alone the elements of Art, but its history, its psychology, and its evolution." A. C. H.

ADAM HILGER.

BY the death of Adam Hilger, which took place on April 23, the physical sciences, and especially astronomical physics, have suffered a loss which cannot be immediately made good. Standing in the front rank of practical opticians, he did much to promote scientific progress along various lines, his thorough scientific training enabling him to undertake optical work of the highest character.

Born in Darmstadt, in 1839, he early showed a marked inclination for the mechanical work in which his father was then engaged. For some years he was a mechanical engineer in Darmstadt, and he afterwards entered Ertel's famous establishment at Munich. He next came to London, but, though commanding a good salary, he found no opportunity of advancing his knowledge, and soon left for Paris, where he had the good fortune to find employment with the firm of Lerebours and Secretan. During this engagement he constructed many instruments, under the direct supervision of Foucault, and became fully acquainted with the theory, as well as with the practice, of his art. After the war of 1870 he came to London with his family. Here he was engaged with Mr. Browning, at first as a simple workman, but afterwards as foreman. Having completed a five years' contract, he commenced business on his own account at Islington. At these well-equipped works he produced the instruments which have brought him such a high reputation among physicists and astronomers throughout the world. He was especially skilled in

manipulating quartz and Iceland spar for work on the ultra-violet rays, and had lately succeeded in making very perfect achromatic combinations of these materials. The special qualities of the new Jena glasses were also well known to him, and by their use he produced achromatic lenses of very short focal length, as well as prisms of very high dispersion.

We understand that the business will be, in all probability, continued by Mr. Otto Hilger. A. F.

A NIGHT IN MID-MAY.

NOW tender eve has kissed the drooping eyes
Of sleeping daisies; incense floods the air,
Bowed Nature kneeling at her vesper prayer;
Mid rustling leaves the pensive night breeze sighs.
In heaven's great garden brighter flowers arise;
While throned Arcturus fires the southern skies;
Aglow the coils of Berenice's Hair;
Her wonted path the patient moon makes fair.
Calm whisperers! of splendours far away,
Glad messages in golden light ye bring—
A heart's desire fulfilled one happy day,
In perfect love and never ending spring,
Where painless pleasure shall no more take wing,
Nor spectral winter close the eyes of May.

M. C. L.

NOTES.

THE Bakerian Lecture will be delivered at the Royal Society on Thursday next, May 20, by Prof. Osborne Reynolds, F.R.S., and W. H. Moorby. The subject will be the mechanical equivalent of heat.

DR. E. J. STONE, F.R.S., Radcliffe Observer at Oxford, died on Sunday last. Astronomy has thus lost one of its foremost workers.

WE join in the general expression of regret at the death of the Duc d'Aumale, a very distinguished member of the French Academy. He spent a great part of his life in England, and received the honorary D.C.L. at Oxford in 1891. He frequently appeared at the Athenæum Club, and his interesting personality was therefore known to many who were not his fellow-countrymen. By a deed of gift, executed in 1884, the Duc d'Aumale's château at Chantilly, and all its precious contents, was presented to the Institute of France, in trust for the French nation, subject only to his life interest in the château. The Paris correspondent of the *Times* gives particulars of this splendid gift. By the terms of the bequest Chantilly must preserve the character of a museum. The exterior wings are assigned as lodgings for the three curators, and the museum, under the supervision of the Institute, will be an institution open to the public. Besides this, the Institute, to meet the expense of the preservation of Chantilly, is given the forest, the annual clearings in which produce about 100,000 francs. It also possesses other portions of the estate, which will produce more than the sum necessary for the maintenance of a museum. France will thus always possess a magnificent monument to the memory of one who held national welfare very dear.

THE annual conversazione of the Society of Arts will be held at the South Kensington Museum, on Wednesday, June 16.

THE Yachting and Fisheries Exhibition at the Imperial Institute will be opened by their Royal Highnesses the Prince and Princess of Wales, on Monday, May 17.

THE *Lancet* states that the Government of India, recognising the arduous and valuable nature of M. Haffkine's recent work in connection with the bubonic plague, has sanctioned the grant of a monthly salary of Rs. 2000 to him instead of the

allowances hitherto given. This arrangement is to have a retrospective effect from the date on which he began work in Bombay.

THE Committee of the Puffin Island Biological Station have decided to offer facilities to students and others for the pursuit of scientific research at the station during the summer months. The island is well situated for the study both of marine zoology and ornithology, and the station is provided with sleeping accommodation in addition to the usual laboratories. Those wishing to avail themselves of the present opportunity should communicate with the Director, Prof. P. J. White, University College of North Wales, Bangor.

At the annual meeting of the Institution of Civil Engineers, recently held, the Chairman was able to announce some important changes which have recently been made in the management of this Society, which are calculated to bring its proceedings more up to date. Hitherto, new members and associates have been admitted on a kind of guarantee, signed by a certain number of existing members, that the applicant is, by training and experience, duly qualified to act as a Civil Engineer; and although in recent years the Council have taken steps to ascertain that the candidate has been properly educated, no direct examination has been required. In future, in addition to the requirements now in force, a test examination of the general and scientific knowledge of candidates for election into the class of associate members will be required. A further departure from old customs, which has also recently taken place, is that members can now vote for the annual election of the President and Council by balloting papers, without personal attendance at the meetings, as used formerly to be necessary. The roll of members of this Institution now numbers 6204, and is constantly on the increase. The last year's annual income amounted to 22,285*l*. A large amount out of the capital funds belonging to the Society has recently been expended on the new building in Great George Street.

WE regret to announce the death, on the 7th inst., of Mr. Abraham Dee Bartlett, the well-known resident Superintendent of the Zoological Society's Gardens in the Regent's Park. Mr. Bartlett was born in London in 1812, and was formerly in business as a dealer in natural history specimens. After a short period of office as head of the Natural History Department at the Crystal Palace when it was instituted, Mr. Bartlett was appointed Superintendent of the Zoological Gardens in 1859, shortly after Mr. Sclater became Secretary, and continued in the efficient performance of his duties until about six weeks before his decease. In his practical knowledge of living animals Mr. Bartlett was unrivalled, especially as regards mammals and birds. No one knew better than he whether an animal offered for sale was sound or sick, or was a better judge of its value. He was also an excellent observer of the habits and structure of the animals under his charge, and communicated many valuable papers to the Zoological Society's scientific meetings on these subjects. One of the most remarkable of these was that on the shedding of the horns by the Prongbuck (*Antilocapra americana*), published in 1865. Mr. Bartlett's discovery of this curious phenomenon was at first discredited by the American naturalists, but the fact is now universally admitted.

THE death is announced of Mr. Matthew Carey Lea, of Philadelphia, at the age of seventy-four. From an obituary notice in the *American Journal of Science* we derive the following particulars of his work:—"Mr. Carey Lea was elected a member of the National Academy of Sciences in 1892, and the list of his more important papers then published contained fifty-four titles. These investigations for the most part related to the chemistry of photography, and especially to the action of

light and other forms of energy upon silver salts. He described photo-bromide and photo-iodide of silver, and in 1887 published a paper on the 'Identity of the photo-salts of silver with the material of the latent photographic image.' His most remarkable discovery, however, made in 1889, was that silver is capable of existing in three allotropic states. The first is allotropic silver proper, 'which is protean in its nature, may be soluble or insoluble in water, may be yellow, red, blue or green, or may have almost any colour, but in all its insoluble varieties always exhibits plasticity; that is, if brushed in a pasty state upon a smooth surface, its particles dry in optical contact and with brilliant metallic lustre. It is chemically active.' The second is intermediate in character, may be yellow or green, always shows metallic lustre, is never plastic, and is chemically indifferent. The third is ordinary silver."

WITH much regret we have to announce the death, on May 5, of Mr. J. Theodore Bent, who had just returned from a journey, with Mrs. Bent, in Sokotra, and in southern Arabia, in the course of which they had made some remarkable discoveries. Both had suffered from malarial fever, and Mr. Bent succumbed to a subsequent attack of pneumonia. For twenty years Mr. and Mrs. Bent spent a large part of each winter in travelling, and their later journeys have been described in several books. The more important were those in Greece and Asia Minor, in the course of which Mr. Bent acquired remarkable facility in modern Greek, and established his reputation as an archaeologist; in the Bahrein Islands of the Persian Gulf; in Mashonaland, where he was the first to systematically study the wonderful ruins of Zimbabwe; in Abyssinia; on the Red Sea coast of Egypt; and to Hadramut, in southern Arabia. A leading object in the later journeys was to investigate the extension of the Sabæans at the period of their prosperity as a trading nation. Mr. Bent read many important papers to the Royal Geographical Society, the British Association, and other Societies. His unique collections of antiquities have been exhibited at the Royal Society's conversaciones, and his gatherings from numerous wanderings made his house a veritable museum. While his death is a serious loss to archaeology and geography, the personal sorrow which it occasions is greater than in the case of most explorers. Mr. Bent had a very large circle of devoted friends, which, with a frank kindliness peculiarly his own, he was ever widening. The unaffected heartiness of his manner to all, and his readiness to assist every one engaged in kindred studies, will not soon be forgotten. Although he died at the age of forty-five, Mr. Bent leaves behind him the memory of more kind actions and helpful words than can be placed to the credit of most men whose lives have ripened into old age.

THE new Ostrich-and-crane-house in the Zoological Society's Gardens has lately been completed, and is already fully tenanted. The compartments on the south side accommodate all the struthious birds, which have now for the first time been brought together from different parts of the Gardens. The most recent addition is a fine adult male of the Somali ostrich (*Struthio molybdophanes*), remarkable for the bluish tinge of the naked parts, which in the Northern ostrich are red. The sixteen compartments on the north side are occupied by a fine series of cranes and storks.

THE anniversary meeting of the British Ornithologists' Union was held in the Zoological Society's Offices, 3 Hanover Square, on the 5th inst.; Mr. P. L. Sclater, F.R.S., in the chair. The report of the Committee gave a very favourable account of the Union's affairs, and of the progress of its journal, the *Ibis*, which has now been carried on successfully for thirty-eight years. Twenty-four new members were elected, raising the strength of the Union to more than 300. For the ensuing

year Mr. F. D. Godman, F.R.S., was elected president, and Mr. O. Salvin, F.R.S., secretary, the editors of the *Ibis* (Messrs. Selater and Saunders) remaining as before.

THE first of a series of ten lectures, on the structure and distribution of birds, was given at the Zoological Society's Gardens on May 6, by Mr. F. E. Beddard, F.R.S., prosector to the Society. The lecture dealt with the main points in the external and internal anatomy of the class, special weight being laid upon those characters which are associated with the flight of birds. The lecturer gave a short *résumé* of the characters of the feathering of birds, not omitting to mention that, at present, baffling problem—the presence or absence of the fifth cubital remex. Attention was directed to the fact that although, on theoretical grounds, a continuous feathering, like that of the penguins and struthious birds, was to be looked upon as the primitive state of affairs, it was doubtful whether, in existing birds, the close feathering was not a secondarily acquired character. In support of this, the transitory existence of marked apteria and pteryllæ in the chick-ostrich, as first described by Miss Lindsay, was pointed out. In describing the essential features of the skeleton, the lightness of the bones, the massing of the chief weight in the middle of the body, the structure of the hand, and various matters illustrative of the adaptation of that part of the organism to the purposes of flight, were dwelt upon.

PROF. HANKIN'S report to the Bombay Chamber of Commerce, concerning the infection of grain and the vitality of the bacillus of plague in infected grain, is thus summarised in the *British Medical Journal*. (1) The microbe has not been found in either stored grain or in parasitic insects inhabiting grain. (2) Grain can be infected by a pure culture of the bacillus of plague, so that an extract made therefrom will cause death from plague in animals (mice). (3) The potency of grain-infected extract rapidly diminishes, so that in a few days it does not kill. Thirteen days is the extreme limit of possible potency; but Prof. Hankin is led to the belief, by his experiments, that plague bacilli obtaining admission to grain stored as on board ship would certainly become non-infective in four to six days.

THE definition of a standard or standards of thermal efficiency for steam-engines was referred to a Committee of the Institution of Civil Engineers last year; and the gist of the conclusions, which have just been arrived at, is as follows: (1) That the statement of the economy of a steam-engine in terms of pounds of feed-water per horse-power per hour is undesirable. (2) That for all purposes, except those of a scientific nature, it is desirable to state the economy of a steam-engine in terms of the thermal units required per horse-power per hour (or per minute), and that if possible the thermal units required per brake horse-power should also be given. (3) That for scientific purposes the thermal units that would be required by a perfect steam-engine working under the same conditions as the actual engine should also be stated. The proposed method of statement is applicable to engines using superheated steam, as well as to those using saturated steam, and the objection to the use of pounds of feed-water, which contain more or less thermal units according to conditions, is obviated; while there is no more practical difficulty in obtaining the thermal units per horse-power per hour than there is in arriving at the pounds of feed-water. For scientific purposes the difference in the thermal units per horse-power required by the perfect steam-engine and by the actual engine shows the loss due to imperfections in the actual engine. It is pointed out that a further advantage of the proposal is that the ambiguous term "efficiency" is not required.

IN the *Mittheilungen der K. K. geographischen Gesellschaft*, in Vienna (vol. xl. Nos. 1 and 2), there is an exhaustive memoir

on the Karlseisfeld or Hallstätter Glacier of the Dachstein. The first part is devoted to a minute examination of the topography of the region, and the second to an account of the methods and results of a careful survey made by the author. An excellent map is appended.

THE current number of *Petermann's Mittheilungen* contains the first instalment of a new estimation of the areas of non-European river-basins, by Dr. Alois Bludau. The numbers for South America are here given. Sixteen separate basins make up a drainage area of 16,275,000 square kilometres to the Atlantic; the Pacific slope, divided into four regions, accounts for 1,056,000 square kilometres; leaving the Titicaca and similar regions, without an outlet to the sea, the remaining 274,000 square kilometres.

WE have received from the author a contribution to the rapidly increasing literature of limnology—"Zur Entstehung der Alpengseen," by Dr. L. Swerinzew. Dr. Swerinzew criticises a good deal of recent work somewhat severely, and comes to the conclusion that a number of the types of lake-basins now regarded as different, are really identical as regards their mode of origin and development. About 90 per cent. of the Alpine lakes found in valleys are held to have been formed simply by the erosive action which gave rise to the valleys themselves.

M. DE LAPPARENT contributes to *La Nature* a note on some further considerations suggested by Nansen's discovery of a deep Arctic basin. He points out that the area we may now assign to the Arctic Ocean is almost the same as that given by Murray to the Antarctic Continent—about four and a half million square kilometres, while the depths observed by Nansen correspond in order of magnitude to the heights observed by Ross; and it is remarkable that a small area like the Arctic Ocean should give soundings equal to the averages obtained in the Atlantic and Pacific. These considerations, similar to those which have led Mr. Lowthian-Green to assume that the earth has a tetrahedral form, suggest that it may really be top-shaped, the spinning point, as it were, being the South Pole. Such a supposition would tend to reconcile the differences of astronomers and geodesists as to the ratio of the polar and equatorial diameters; for the latter base their value of the polar flattening, $1/294$, upon measurements made almost entirely in the northern hemisphere. The value obtained by M. Tisserand from the precession of the equinoxes, $1/297$, may be found sensibly correct, if the existence of the south polar protuberance, and consequent effects upon the form of the sea surface, are admitted.

SINCE the great earthquake of 1855, the strongest felt in Tokio was that of June 24, 1894, which forms the subject of a valuable paper contributed by Prof. F. Omori to the Italian Seismological Society. The entire land-area disturbed was about 110,000 square miles. The meizoseismal area was a band lying to the east of Tokio, and running north and south, from Iwatsuki to the Bay of Tokio. This band occupies the lowest part of the plain of Musashi, which is the continuation of the axis of the bay, and the earthquake was probably connected with a long fault lying beneath the meizoseismal band. Records of the earthquake were obtained at two observatories in Tokio. At one of these, situated on high and hard ground, the earthquake consisted of one prominent oscillation, preceded and followed by smaller vibrations; the maximum horizontal displacement being 73 mm. in the direction S. 70° W. and N. 70° E., and the maximum horizontal acceleration 444 mm. per sec. per sec. At the other observatory, which is on low and soft ground, the horizontal displacement was 130 mm., and the maximum acceleration about 900 mm. per sec. per sec. Prof. Omori believes that near the epicentre of a great earthquake, the movement is generally of the same simple character

as that above described, combined with a definite direction of the shock. Slighter earthquakes usually consist of a great number of small vibrations of nearly equal amplitude executed in different planes.

THE method of the computation of the Chinese calendar is described with clearness by Paul d'Enjoy in the *Bulletins de la Soc. d'Anthropologie*, 1896, p. 562. Every year is named by a combination of two words according to a fixed rule, and the special combination is supposed to indicate the fortunes of the year. The year 1896 was the period of the external hearth and the monkey; that is a time of dangers from abroad, which must be met by cunning and dexterity. Unfortunately for the Chinese, it was the Japanese that exhibited these qualities! In 1897 the Chinese enter calmer times, under the auspices of the internal hearth and the chicken. Next year the activity of the nation will be diverted from the cultivation of the soil, and turned towards watchfulness and the protection of the home, as the yearly combination is waste-land and dog. The months, weeks, days and hours are also described. Each of their hours corresponds to two European hours, of which seven belong to the day, and five to the night; the first hour commences at 11 o'clock at night. M. d'Enjoy states that Belgium is about to adopt the principle of the Chinese double hours for the official railway time-tables.

WHAT Sir William Flower has to say upon "Natural History as a Vocation," carries great weight; so parents with children who have proved the earnestness of their interest in nature's life and moods, should turn to an article in *Chambers's Journal* (May) if they wish to know exactly what are the prospects of the livelihood obtainable by following the inclination. "As to natural history as the regular occupation of one who has no other means of living," says Sir William Flower, "I have little to say that is favourable, as it is about the worst paid and least appreciated of all professions." There are signs, however, that the prospects are brightening, and the youth who feels confident of his ability "to scorn delights and live laborious days," may eventually find his way to a position as a lecturer, demonstrator, or curator. To pursue the vocation with any chance of success, he must have a considerable knowledge of modern languages and other subjects, as well as of natural history. He should begin wisely to collect specimens, and should educate himself by his collection; for, Sir William Flower points out, "The arrangement of a collection not only teaches the nature and properties of the objects contained in it; it also stimulates a desire to know more of the similar objects not contained in it, but to be found in other and larger collections. Still more important than this, as an educator, it calls out many valuable practical qualities: originality, order, neatness, perseverance, taste, power of discriminating small differences and resemblances, all of which will be found useful in other spheres of life." Sir William Flower's first "museum" was contained in a large, flat, shallow box with a lid; and one of the first specimens he possessed was a badly stuffed specimen of the dipper or water ousel.

IN the *American Journal of Mathematics*, xix. 3, Dr. G. H. Bryan gives a brief account of certain applications of the theory of probability to physical phenomena. The main difficulty in accounting for such phenomena by means of the principles of theoretical dynamics lies in the fact that the equations of motion of an ideal system always represent reversible processes, which in nature are conspicuous by their absence. The author proceeds to examine how far the difficulty may be overcome by introducing the theory of probability, especially in connection with the kinetic theory of gases, and he gives a short *résumé* of

certain investigations by Prof. Boltzmann, from which it is found that, under certain assumptions, the most probable distribution of the coordinates and momenta of the molecules of a gas is that which has been termed the Boltzmann-Maxwell distribution. Unfortunately, however, the proofs involve certain initial assumptions, and, on varying the nature of these, the results as to the most probable final distribution will be different. It would thus appear that even probability considerations do not afford unassailable proofs of the law which forms the usually accepted basis of the kinetic theory—a result completely in accordance with Mr. Burbury's recent investigations, according to which assemblages of densely-crowded molecules do not conform to that law.

FROM a number of papers before us dealing with cathodic and Röntgen rays, we extract the following. Dr. Garbasso (*Nuovo Ciment*, 4, iii.), in discussing the effects of products of combustion on the length of the electric spark, considers that if flames produce certain actions on the sparks, like those of Röntgen rays, it is because they are the seat of chemical phenomena, since in the products of combustion there exist dissociated molecules, in other words electrified particles. It seems probable that Röntgen rays and ultra-violet light act on sparks for the same reason.—Dr. Quirino Majorana (*Atti dei Lincei*, vi. 5) discusses the electrostatic deviation of cathodic rays, such as can be studied by the introduction of a second cathode or anode in the discharge-tube.—M. L. Benoist (*Bulletin de la Société Française de Physique*, 91) has attempted to discover the law of transparency of substances for Röntgen rays. Defining the *specific absorbing power* as the absorption produced by a layer of unit surface density (or of 1 decigramme per square centimetre), M. Benoist finds that for ordinary rays this power increases with the density, but the results vary with the quality of the rays themselves. The author advances the view that the law of density (according to which the specific absorbing powers of all substances are equal) is a kind of *limiting* law towards which the results of observation tend as rays of higher frequency are produced.—M. Jean Perrin, in discussing the laws according to which electrified bodies are discharged (*Bulletin de la Société Française de Physique*, 93) considers that when the rays actually reach the conductor, two separate factors must be taken into account, viz. the "metal effect" produced by the incidence of the rays on the conductor, and the "gas effect" due to their action when traversing the gas. By considering the two terms separately, the law of discharge can be represented by a simple mathematical formula.—M. Désiré Korda, in the same number of the *Bulletin*, calls attention to a remarkable dissymmetry produced by Röntgen rays in vacuum tubes, and which he has observed in experiments undertaken in conjunction with Dr. Oudin.

WE have received a report of the results obtained from the experimental fields for the cultivation of the sugar-cane in Antigua, by Mr. F. Watts and Mr. F. R. Shepherd. The experiments were mainly on the advantages to be derived from the use of mineral manures in the cultivation of the cane. The remarkable and unexpected result was obtained that the addition of phosphates to the soil diminishes the yield of sugar. Nitrogen, in the form of ammonium sulphate, sodium nitrate, or dried blood, has a slightly beneficial effect on the yield; potash a much greater beneficial effect.

THE Report of the Kew Observatory Committee for the year 1896 states that the magnetic curves during the past year have been quite free from any very large fluctuations. The earthquake of December 17 was shown slightly on the Declination curve, but more distinctly on the Horizontal Force curve. The mean Westerly Declination for the year was $17^{\circ} 10' \cdot 8$,

and the mean Inclination $67^{\circ} 22' 3$. In the various experiments carried on at the observatory, particular attention has been paid to observations of atmospheric electricity, and to the comparisons of mercury and platinum thermometers. The number of instruments verified during the year exceeded 20,500.

M. CAMILLE FLAMMARION brings together (*Bulletin de la Société Astronomique de France* for May) some statistics regarding the amount of rainfall in Paris since the year 1688, which discloses the remarkable fact that a gradual increase in the fall for the last two hundred years is indicated. A glance at the yearly means does not, perhaps, give such a decided apparent increase as a survey of the means obtained by grouping several years together. The following brief table, extracted from M. Flammarion's note, speaks for itself:—

				mm.
1689 to 1719	...	...	...	485'7
1720 „ 1754	...	...	...	409'4
1773 „ 1797	...	...	...	492'5
1804 „ 1824	...	...	...	503'7
1825 „ 1844	...	...	...	507'5
1845 „ 1872	...	...	...	522'4
1873 „ 1896	...	...	...	557'4

Whether this "increase" is actually due to more rain, or to some such causes as better positions for rain gauges, or more improved rain gauges themselves, one cannot with certainty say, but the amount of increase seems rather to negative this. The figures, nevertheless, are very astonishing; and it would be interesting to examine other series of observations extending over a long period.

THE Geological Commission of Cape Colony has published a bibliography of South African geology, containing a list of nearly six hundred papers.

ASTRONOMERS will be interested to know that Mr. Henry Frowde has in hand "Tables for Facilitating the Computation of Star-Constants," by Dr. E. J. Stone, F.R.S., Radcliffe Observer at Oxford, modified and revised by Pr. H. H. Turner. We much regret to have to add to this announcement that Dr. Stone died on Sunday last.

IN papers recently published in the *Bulletin* of the American Museum of Natural History (November 1896 and March 1897), Dr. J. L. Wortman makes an important contribution to the knowledge of Mammalian descent. He unites six genera of primitive Mammalia, from various horizons in the North American Eocene, into a sub-order Ganodonta, and maintains that they are the ancestors of the New World Edentates. In following one of the families of this sub-order up through successive stages of the Eocene, he finds the genealogy to be completely traceable; at the end of that period the line disappears altogether, but is taken up again in the Edentates of the Santa Cruz formation of South America. An almost inevitable conclusion from this is that about the end of the Eocene there was at least a temporary land connection between the two Americas.

MESSRS. JOHN WALKER AND CO., LTD., have sent us several packets of their "Perfection Envelope," which have been designed to do away with the necessity of licking, or otherwise moistening, the gum on the flap of an envelope in order to make it adhere. The gum is placed upon the back of the envelope instead of on the flap, so that by moistening the flap the envelope can be sealed without touching the gum with the tongue. The advantage thus gained is not very clear, for it is possible in the case of any envelope to moisten the back instead of the gummed flap. What is really required is a simple device for sealing envelopes without going through the very objectionable practice of licking them.

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A SECOND edition of Prof. Lester F. Ward's "Dynamic Sociology, or Applied Social Science, as based upon Statistical Sociology and the less Complex Sciences" (two volumes) has been published by Messrs. D. Appleton and Co. The work first appeared in 1883, when there was not a chair of Sociology in any University in the world. Now there is a small army of active professors of Sociology in the United States alone, and the demand has consequently arisen for a new edition of Prof. Ward's pioneer work. Very little revision has, however, been made. An amusing story is told by Prof. Ward with reference to his volume. The book was interdicted in Russia, but the grounds upon which the action of the Russian Government was based were not clear until a correspondent suggested that the cause of trouble was the title, which appeared to be "a compound of *socialism* and *dynamite*."—A second edition of Dr. L. Edmunds' "Law and Practice of Letters Patent for Inventions" has been prepared by Dr. T. M. Stevens, and is published by Messrs. Stevens and Co. The first edition of the book appeared in 1890, and was reviewed in our columns in that year (vol. xliii. p. 53).—Prof. E. A. Schäfer's very instructive "Course of Practical Histology" (Smith, Elder, and Co.) has reached a second edition. The volume is a practical handbook in which practicable methods are described. Its aim is "to assist the student to carry on histological work independently of the constant presence of a teacher"; and well is this purpose realised throughout the book.—Messrs. E. and F. N. Spon have published a third, considerably enlarged, edition of "The Engineer's Sketch-Book," by Thomas W. Barber. The work contains 2603 sketches of "mechanical movements, devices, appliances, contrivances and details employed in the design and construction of machinery for every purpose, classified and arranged for reference for the use of engineers, mechanical draughtsmen, managers, mechanics, inventors, patent agents, and all engaged in the mechanical arts."

AMONG noteworthy papers and other publications which have come under our notice within the past few days are the following:—Dr. Fridtjof Nansen contributes to the *Geographical Journal* (May) a valuable outline of the scientific results obtained during the Norwegian Arctic Expedition. The same journal contains a full report of the discussion of the North Polar problem, at the Royal Geographical Society on March 22.—Mr. J. Holt Schooling illustrates "The Weight of the Earth" with several ingenious diagrams in the *Strand Magazine*.—Three books, by Prof. C. Lloyd Morgan, referring to the human mind and animal intelligence, furnish the text for an article in the *Quarterly Review* (No. 370, April).—Two papers on the structure and physical characters of striped muscular fibre, and the phenomena of its construction, appear in the *Journal of Anatomy and Physiology* (April), and form useful contributions to a subject which has for many years furnished histologists and physiologists with material for controversy.—The notes on progress in petrography, contributed during 1896 to the *American Naturalist*, by Mr. W. S. Bayley, have been brought together in a pamphlet, which should prove very serviceable for reference.—In the *Proceedings* of the Royal Society of Victoria (vol. ix.), containing papers read before the Society during 1896, are described: A new species of marsupial from Central Australia; aboriginal rock painting in the Victoria Range, County of Dundas, Victoria; geographical distribution of land and fresh-water vertebrates in Victoria; the temperatures of reptiles, monotremes and marsupials; the "Burbung" of the New England Tribes, New South Wales, and the "Bora" of the Kamilaroi Tribes (these detailed descriptions of ceremonies of Australian native tribes are based upon personal observations made by the author, Mr. R. H. Mathews); a contribution to the knowledge of the Tertiaries in the neigh-

bourhood of Melbourne; and the values of the wave-lengths of the spectrum lines of the alkalies, as determined by a new periodic formula.—A discourse pronounced by the late Dr. du Bois-Reymond in honour of the memory of Hermann von Helmholtz, is now published by Veit and Co., Leipzig. The discourse is a full and valuable statement of Helmholtz's life and scientific work.

THE additions to the Zoological Society's Gardens during the past week include an Orang-outang (*Simia satyrus*, ♀) from Borneo, presented by Lord Ashburton and the Earl of Crawford; a White-crowned Mangabey (*Cercocebus ethiops*, ♀) from West Africa, presented by Mr. Bernard A. Collins; a Malayan Bear (*Ursus malayanus*, ♀) from Malacca, presented by Lord and Lady Ashburton; a Nightingale (*Daulias lusciniæ*), British, presented by Mr. W. H. St. Quintin; three Common Boas (*Boa constrictor*) from the Tefé River, Upper Amazons; a Brazilian Tortoise (*Testudo tabulata*) from Brazil, presented by Mr. H. C. Fernando Rohé; a Phayre's Tortoise (*Testudo emys*) from Borneo, presented by H. H. the Tuan Muda of Sarawak; a Forsten's Lorikeet (*Trichoglossus forsteni*) from Sumbawa, a Blue-faced Lorikeet (*Trichoglossus hematodes*), two Perfect Lorikeets (*Psittuteles cuteles*) from Timor, a Phayre's Tortoise (*Testudo emys*) from Borneo, deposited; a Malbronck Monkey (*Cercopithecus cynosurus*, ♂) from Congoland, two Phayre's Tortoises (*Testudo emys*) from Borneo, two Long-tailed Grass-Finches (*Poephila acuticauda*) from North-west Australia, purchased.

OUR ASTRONOMICAL COLUMN.

MAY METEORS.—During the month of May the number of meteors is by no means considerable, the records showing quite a dearth of deduced radiant points at this season of the year. One, however, which seems to be, to some extent, prominent (*Astr. Nach.*, No. 3418), is that which is situated in the region near the brightest star in Corona. The Greenwich observers in 1866 one evening recorded no less than seven first magnitude meteors, and five fainter ones, in the course of an hour; and Mr. Denning tells us that he himself made some very successful observations in 1885. This observer is of opinion that previous observations indicate the occurrence of a special shower, and he gives, as a mean of many determinations of the positions of radiant points, the coordinates $232^{\circ}8' + 28^{\circ}6'$. May 18 is given as the day on which special attention should be devoted to this shower.

CENTRALSTELLE TELEGRAMS.—We have received a communication from Prof. H. Kreutz, in Kiel, which informs us that he has taken over definitely the direction of the Central Bureau for astronomical telegrams, and that in future the telegraphic address will *not* be Bureau der Centralstelle, Königlichen Sternwarte, Kiel, but Astronomische Centralstelle, Kiel. Prof. Kreutz also incloses the "Statutes" of the Centralstelle, which have been recently revised.

ACCIDENTAL ERRORS OF TALCOTT OBSERVATIONS.—From a series of observations, 500 in number, made with the object of determining the latitude of Hong Kong, Herrn Doberck (*Astr. Nach.*, No. 3418) states some interesting facts about the choice regarding magnitude of stars that will be useful to observers using the Talcott method. It has been previously found that neither the zenith distance, nor the amount of the difference of zenith distance, if within $10'$, affects the error of the results; neither is the difference of right ascension, if less than 20 m. , affected. Herrn Doberck suggests that these limits might with advantage be extended: it is better to "observe bright stars with zenith distance greater than 20° , difference of right ascension greater than 20 m. , and difference of zenith distance greater than $10'$, than to observe fainter stars within these limits, as the accidental errors of observation increase when the brightness of the stars decreases." Taking the average magnitude of each pair of stars from 3.5 magnitudes up to the 7th magnitude, he gives a table showing the probable errors of one observation for each increase of half a magnitude.

FURTHER STUDIES ON SNAKE POISON AND IMMUNITY.

PROF. CALMETTE, whose name is so indissolubly associated with the study of snake bites and their treatment by anti-venomous serum, has lately published in the *Pasteur Annales*, in conjunction with his assistant M. Delarde, a most interesting and highly important series of experiments helping to elucidate the mechanism of immunity. Endeavouring to throw light upon some of the problems surrounding this highly complex question, Calmette has selected two different kinds of toxin, the one vegetable and the other animal.

The vegetable toxin was furnished by the substance known as abrine, which is the active principle of the seeds or beans of *abrus precatorius*, a leguminosa common in India and South America. It is a highly toxic material, and one milligramme suffices to kill a rabbit in forty-eight hours. Very few animals apparently can resist its action, and so far as Calmette's observations go, this immunity is restricted to hedgehogs, fowls, tortoises, snakes (*couteuvres*) and frogs. It requires as much as ten milligrammes of abrine to destroy either a hedgehog or a fowl in forty-eight hours, whilst a tortoise only succumbs after a dose of thirty milligrammes.

The animal toxin selected for these experiments was, as might be expected, serpent venom, consisting of a mixture of venoms derived from various kinds of poisonous snakes.

In the course of his previous researches, Dr. Calmette was led to believe that snakes had a charmed life against all injections of serpent venom; but he now tells us that his earlier conclusion requires correction. He has succeeded in killing Egyptian asps and a serpent native to Indo-China by injecting doses of venom three times as great as that normally present in their respective poison glands, and he is, therefore, of opinion that although reptiles do possess great powers of resisting the toxic effect of serpent venoms, yet, contrary to what he at first supposed, their immunity to this poison is not absolute.

Various hypotheses have been suggested to account for this comparative immunity exhibited by reptiles to the effect of venom, and Prof. Fraser, of Edinburgh, has attributed this phenomenon to the presence in the blood of reptiles of some anti-toxic substance. Calmette, however, has shown that, far from protecting animals from the toxicity of venom, reptile blood causes their death. Experiments in this direction were not only made with the blood derived from the liver and other organs of a *naja tripudians*, but also with injections of a filtered aqueous emulsion of these organs, but in no case was any protective action recorded.

Again, the serum of pigs, which animals in some countries are specially trained for the purpose of hunting serpents, which they devour greedily without suffering the least inconvenience from their bites, the serum of these animals has no modifying action whatever outside the body, *in vitro*, on serpent venom, and has no protective action.

Similar experiments were also made with animals exhibiting a relative immunity to the toxic action of the vegetable poison, *i.e.* abrine. It was found that whereas the normal serum of hedgehogs, which animals possess a natural immunity to abrine poisoning, can protect other animals susceptible to this toxin from its lethal effects, yet to do so effectually large quantities of the serum in question must be employed. On the other hand, fowls and tortoises, although also naturally immune to the abrine toxin, can confer, by means of their serum, no protective power whatever upon other animals against this poison.

The next question approached by Calmette was whether these so-called refractory animals can elaborate anti-toxins, and in the course of his experiments on this subject he obtained some very curious results.

For these investigations abrine only was employed, and profiting by the fact that fowls and tortoises had proved very refractory to this toxin, these animals were chosen as subjects for the inquiry.

Two fowls were given, in the course of twelve days, about eight milligrammes of abrine. Whilst, as we have seen, ordinary fowl-serum can confer no immunity from the effects of abrine poison, the serum derived from the abrine-treated fowl was possessed of immunising properties. In this case, therefore, a refractory animal, normally incapable of yielding an anti-toxic serum, had been trained by artificial means to do so. Similar experiments made with another refractory animal gave, however, quite different results, for when tortoises were treated with abrine poison, instead of their serum acquiring any protective